

Bridging the Gap: The Untapped Potential of the MV-22 Osprey

EWS Contemporary Issue Paper

Submitted by Captain C.J. Klemko

to

Major A. A. Angell, CG 11

24 February 2008

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 24 FEB 2008		2. REPORT TYPE		3. DATES COVERED 00-00-2008 to 00-00-2008	
4. TITLE AND SUBTITLE Bridging the Gap: The Untapped Potential of the MV-22 Osprey				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Marine Corps,Command and Staff College, Marine Corps Combat Development Command,Marine Corps University, 2076 South Street,Quantico,VA,22134-5068				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 18	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

EPIGRAPH

The MV-22 Osprey tiltrotor is an advanced-technology vertical/short takeoff and landing (V/STOL), multi-purpose tactical aircraft that will replace the current fleet of Vietnam-era CH-46E and CH-53D aircraft. The MV-22 [is] an integral part of the Seabasing pillars necessary to execute Expeditionary Maneuver Warfare.... The MV-22 will be the cornerstone of Marine Corps' assault support capability, possessing the speed, endurance, and survivability needed to fight and win on tomorrow's battlefield. This combat multiplier represents a quantum improvement in strategic mobility and tactical flexibility for expeditionary and Maritime Prepositioning Forces (MPF).

-U.S. Department of the Navy, *Marine Corps Concepts and Programs 2007*, p. 186

There has been much debate over the future of medium lift for the Marine Corps. With the service life of the CH-46E coming to an end, the Marine Corps needed to find a replacement. As technology progressed, a tiltrotor aircraft seemed like an ideal solution. The Marine Corps pursued that option, resulting in the MV-22 Osprey. Over the years, the Osprey program has generated much criticism. Skeptics argued about the safety of the aircraft and maintenance program, and now that the Osprey has achieved its initial operational capability (IOC), the main concern is whether or not the Osprey will be able to fulfill the role of the aircraft it is replacing. A common view exists that the Osprey will be unable to complete all the missions of the CH-46E, thus resulting in a capabilities gap.¹ The major concerns for this capabilities gap revolve around five main issues: escort for the Osprey, the casualty evacuation (CASEVAC) mission, self-defense, landing zone (LZ) criteria, and shipboard operations. However, as technology continues to increase, and tactics, techniques, and procedures (TTPs) continue to be developed and refined, the Osprey is not only capable of accomplishing all of the missions of the CH-46E, but it will also bring an increase in capabilities not available with the CH-46E.

BACKGROUND

Since the early 1980's, the Marine Corps has actively been seeking a replacement for the CH-46E. The advanced tiltrotor technology offered an increased lift capacity, extended range, and a self-deployment capability, and in 1982 the V-22 program originated as the Joint Service Advanced Vertical Lift Aircraft (JVX) program.² The program ran into many setbacks, including two fatal mishaps in 2000 resulting in the loss of 23 Marines. These mishaps resulted in a temporary 18-month stand down, putting the whole program under intense scrutiny. After a thorough review and revision, the program got back on track, and the Osprey completed its operational testing and evaluation, and was set for production.

Marine Medium Tiltrotor Squadron 263 (VMM-263) became the first tiltrotor squadron to achieve its core capable status, meaning it is ready to deploy and assume the basic assault support missions.

In September 2007, VMM-263 departed for Iraq. A couple weeks later, Time magazine published an article by Mark Thompson, who summed up the history of the Osprey in a very negative aspect, claiming the Osprey was still unsafe and not ready for a combat environment.³ Immediately, the Marine Corps responded. In an article published by the Marine Corps Times,

Assistant Commandant Gen. Robert Magnus called the Time magazine story "one sided" and "sensationalistic", "full of inaccuracies". The Marine Corps Times article further cites other officials, experts, and sources, all of which refute the claims made in TIME's article.⁴ Even though the Marine Corps Times article thoroughly disputes the TIME article, the relative high visibility of TIME magazine compared to the limited distribution of the Marine Corps Times, did not do much to persuade in favor of the safety of the Osprey. However, Loren Thompson, a military analyst with the Lexington Institute, states the Osprey is the "most thoroughly tested new aircraft in Marine Corps history...tests show it is actually safer than a conventional helicopter."⁵

As further evidence of the safety of the Osprey, since the publication of the TIME article, the Osprey has been having success in Iraq; recently increasing the types and capacity of its missions.⁶ Both the II MEF SgtMaj, SgtMaj Ronald Himsworth, and the II MEF Commanding General, LtGen Kieth Stalder, agree "The deployment of the MV-22s into a combat environment has been very successful, and it has brought our capabilities to the next level."⁷

CAPABILITIES

There is no other rotorcraft with similar capabilities as the Osprey. The Osprey has a lift capacity of 10,000 lbs. It can carry 24 troops. It has a combat radius of 250 miles. It can travel 2100 miles with one aerial refueling. It cruises at an airspeed of 250 knots. It has a service ceiling of 25,000 ft. Summing it up, in comparison to the CH-46, the Osprey can carry 3 times as much, fly 2-5 times farther, and fly twice as fast.⁸ The Osprey is currently configured with a ramp mounted M240 7.62mm machine gun, which allows for nearly 180 degrees field of fire from the rear of the aircraft.⁹ In addition, the Osprey can self-taxi aboard amphibious ships, allowing for faster deck cycles than conventional rotorcraft, which must be towed.¹⁰ When it comes to dusty LZs, "the Osprey is capable of landing without visual reference to the ground via manual pilot control or automatic hovering autopilot functions...based on cockpit instrumentation."¹¹ Also, there is currently a plan to give the Osprey Tactical Bulk Fuel Dispensing System (TBFDS).¹²

As for survivability, the Osprey has the latest in technology: sensors, countermeasures, suppressors, low reflective paint. It is designed to sustain impacts from projectiles, and the airframe and components are designed to absorb an impact from a crash allowing the occupants to

survive.¹³ According to LtGen John Castellaw, the combination of this technology makes the Osprey six to seven times more survivable than the CH-46E.¹⁴

Therefore, with the safety of the Osprey no longer in question, and the stand alone capabilities proven to be greater than the CH-46E, the latest criticism involves integrating these capabilities with current aircraft and capabilities in the fleet. Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) is currently working with the VMM squadrons to develop and update existing TTPs in order to integrate the Osprey's unique capabilities.

TACTICS, TECHNIQUES, AND PROCEDURES (TTPs)

As mentioned earlier, the major concerns for a capabilities gap revolve around five main issues: escort for the Osprey, the casualty evacuation (CASEVAC) mission, self-defense, landing zone (LZ) criteria, and shipboard operations.

The Osprey's faster airspeed (than conventional rotary wing (RW) aircraft) and extended range make escort a challenge. Current fixed wing (FW) escorts do not have the time on station to provide continuous attached escort, nor do they provide sufficient protection in the objective area. Current RW platforms do not have the speed or range to be a viable attached

escort.¹⁵ However, the speed, altitude, and flight profile that Osprey will be transiting at means it will be able to fly outside or around the threat envelopes of most surface-to-air threats. Therefore, it will not be as vulnerable to the same types of threats as the CH-46E, and the main portion of the flight where an escort is needed is in the objective area. According to Maj Eilertson, MAWTS-1 AH-1W pilot, "The hardest nut to crack is the whole escort piece with the MV-22." MAWTS-1 is currently experimenting with different TTPs, such as attached escort with the AV-8Bs and detached escort with the AH-1Ws.¹⁶ Ultimately, the mission and threat will drive the flight profile and escort tactics. While it used to be easy to attach a section of AH-1Ws to a section of CH-46s, escorting the Osprey requires more detailed and integrated planning. However, the extra thought required only creates a capabilities gap when pilots are unwilling to plan accordingly.

One of the more specific escort mission of concern is the CASEVAC mission. TTPs will need to be experimented with, developed, and refined. However, according to Maj Holden, MAWTS-1 MV-22 instructor, the Osprey can climb at a very fast rate, which can quickly put it out of the threat envelope, negating the need initially for an attached escort.¹⁷ Once again, the Osprey will still require an escort in the objective area or landing zone (LZ). One option might be to launch the

escorts and have them arrive at the objective area prior to the Osprey. The AH-1W Cobras can be armed and off the deck in less than 15 minutes. Currently MAWTS-1 is working with the Naval Air Systems Command (NAVAIR) to decrease the response time of the Osprey.¹⁸ Once the Osprey takes off, it flies above or around the threat envelope until at the objective area. Different tactical approaches already established will allow the Osprey to ingress safely to the LZ, with the Cobras already on station. Once the Osprey picks up the casualty, it can depart, once again climbing to avoid the threat envelope and negating the need for an attached escort. The Cobras can then return to base (RTB) and resume their strip alert. Initially, more escorts would be required as current procedures call for one AH-1W and one CH-46E, however, once the casualty is picked up, the escorts are then free to RTB, instead of escorting the package to the appropriate medical facility. The Osprey would then also be free to travel at its cruising speed, getting the patient to help quicker. Gen Castellaw mentions similar tactics in the DOD News Briefing.¹⁹

Since attached escort for the Osprey has limited options, another concern is the Osprey's self-defense capability. Many pilots and aircrew feel that the Osprey needs a forward firing gun²⁰, however, no other assault aircraft in the Marine Corps has this capability. The CH-46 and CH-53 both have door guns and

recently added a ramp gun. Col Walter, head of the Marine Corps aviation plans, programs and budget branch, says "Over the past five years, side gunners firing from the CH-46 Sea Knight and CH-53 Sea Stallion helicopters in Iraq and Afghanistan found that most of the threat was on the ramp."²¹ Future operations and conflicts might demonstrate a need for an all quadrant firing gun, but based on the current operating environment and TTPs, the current gun configuration is suitable until a replacement can be funded and fielded.²²

Another concern is the ability of the Osprey to land in certain LZs. Factors of significance are size, condition, location, and sequencing of other aircraft. The common criticism is that with an increase in downwash, the Osprey will be unable to land in dusty LZs, especially at night.²³ However, the Osprey's "advanced technology makes it easier than in any other rotorcraft to land in brownout conditions."²⁴ Although there exists the potential for a bigger brownout situation, technology and training will mitigate that risk.

Size and location of the LZ are other concerns.²⁵ It is true that the Osprey will require a slightly larger zone due to its wider profile; however, the difference is marginal. In addition, a single Osprey can carry what would normally require two CH-46's. The size of an LZ for one Osprey is still smaller than an LZ for two CH-46's. The issue then becomes location of

the LZ. In an urban zone, with wires, buildings, and other obstacles, the concern is that the Osprey will be too large for those LZs.²⁶ Size of an LZ is a consideration for any rotorcraft. LZs are not normally selected with known obstacles or wires nearby, especially in the center of an urban area with a capacity for an unknown and potentially high threat. LZs also are not normally selected to land a single aircraft, but multiple aircraft. If an LZ really is that restricted, would a commander even risk landing a CH-46 loaded with combat troops at night? If size really does come down to the limiting factor, one option might be to simply move the LZ a half of a kilometer: to a parking lot, schoolyard, stadium, etc. The slightly larger LZ that an Osprey might require is not going to limit a commander's ability or options to accomplish the mission.

One of the last major LZ issues is the sequencing of other aircraft with the Osprey. MAWTS-1 has been experimenting with different sequencing options: the Osprey first, last, simultaneously with other RW aircraft. As with any other objective area planning, more detailed thought and planning will be required; however, MAWTS-1 has had success with all of these options.²⁷ Ultimately, mission and commander's intent will drive the sequencing based on loadout and combat power, but current development of TTPs will provide the commander with the flexibility he needs.

As an expeditionary force, shipboard operations is another concern for the Osprey. One of the next squadrons of Ospreys will deploy with a Marine Expeditionary Unit (MEU). Tests have already been done with different types of ships, and Gen Castellaw states "We (Marine Corps) feel real comfortable with its (the Osprey's) ability to operate in the maritime environment."²⁸ However, the true success will not be measured until the Osprey deploys aboard amphibious ships. In the meantime, TTPs will continue to be developed and refined. As mentioned, the self-taxiing ability of the Osprey will allow for faster deck cycles. The increased time of flight will allow for less deck cycles, and the extended range will allow for greater ship to objective (STOM) operations. Although all missions will still be driven by METT-TSL and commander's intent, the options are limitless, and developing the TTPs will come with time and experience.

CONCLUSION

Despite the common misconception that the Osprey is still unsafe, the aircraft has been thoroughly tested and is considered by experts to be one of the safest aircraft in the Marine Corps' inventory. In addition, its capabilities as a stand-alone platform are much greater than the aircraft it is

designed to replace. Although escort, CASEVAC, self-defense, landing zone (LZ) criteria, and shipboard operations present unique challenges, these issues do not create a capabilities gap. While it is true that the Osprey is untested in many areas, the potential for success is unlimited. Recently, the Osprey began expanding its combat missions in Iraq, and has continued to prove itself.²⁹ As with any new piece of equipment, there will always be a gap between fielding and development of TTPs. With the increase in technology and capabilities, the users will be critical in developing and refining those TTPs. The Osprey is not a matter of "improvisation with what is available."³⁰ It is a matter of integrating new technology and developing TTPs to maximize potential. As Dr. Donald C. Winter puts it, "This aircraft proves that transformation is more than just a buzzword. The combination of range, speed, and operational flexibility the Osprey provides is going to change all the rules for how our Marines engage the enemy."³¹

Word Count: 2472 (including epigraph)

ENDNOTES

- ¹ Capt Matthew R. Crouch, "The Future of Medium Lift," *Marine Corps Gazette* 91, no. 11 (2007): 74-79.
- ² Lindsay Peacock, "Make or break? Osprey prepares for first operational deployment," *International Defence Review*, September 01, 2007.
- ³ Mark Thompson, "The Osprey: A Flying Shame," *TIME*, October 8, 2007.
- ⁴ John Hoellarth, "Leaders, experts slam Time article on Osprey," *Marine Corps Times*, October 16, 2007.
- ⁵ Estes Thompson, *Marine Corps excited about future of Osprey*, Associated Press, July 23, 2005.
<http://www.globalsecurity.org/news/2005/050723-osprey.htm>.
- ⁶ Gordon Lubold, "U.S. Marines' MV-22 Osprey Test: Combat," *The Christian Science Monitor*, December 7, 2007.
- ⁷ Lance Corporal Brian L. Lewis, *II MEF takes a look at 2007 accomplishments*, December 12, 2007.
<http://www.usmc.mil/marinelink/mcn2000.nsf/ac95bc775efc34c685256ab50049d458/d10c609e38f0d7b3852573b0004b741c?OpenDocument&Highlight=2.mef>.
- ⁸ Information compile from multiple sources:
2D Marine Aircraft Wing, "MV-22 Concept of Employment & Staff Officer Primer," Fall 2007.
NAVAIR, V-22 Osprey Web, <http://www.navair.navy.mil/V22/index.cfm?fuseaction=aircraft.main>.
GlobalSecurity.org, V-22 Osprey, http://www.globalsecurity.org/military/systems/aircraft/v-22-mission_req.htm.
- ⁹ 2D Marine Aircraft Wing, "MV-22 Concept of Employment & Staff Officer Primer," Fall 2007, 8.
- ¹⁰ Ibid., 6.
- ¹¹ Ibid., 8.
- ¹² Major Jason T. Holden, MV-22 Instructor, MAWTS-1, phone conversation, December 19, 2007.
- ¹³ 2D Marine Aircraft Wing, "MV-22 Concept of Employment & Staff Officer Primer," Fall 2007, 9-10.
- ¹⁴ U.S. Department of Defense, *DOD News Briefing with Gen Conway from the Pentagon*, April 13, 2007,
<http://www.defenselink.mil/Transcripts/Transcript.aspx?TranscriptID=3932>.
- ¹⁵ Crouch, "The Future of Medium Lift," 75.
- ¹⁶ Maj Philip E. Eilertson, ASD/AH-1W, MAWTS-1, email, December 14, 2007.
- ¹⁷ Holden, MV-22 Instructor, MAWTS-1, phone conversation, December 19, 2007.
- ¹⁸ Ibid.
- ¹⁹ U.S. Department of Defense, *DOD News Briefing with Gen Conway from the Pentagon*, April 13, 2007.
- ²⁰ Mark Thompson, "Giving the Osprey More Firepower," *TIME*, October 17, 2007.
- ²¹ Hoellarth, "Leaders, experts slam Time article on Osprey," *Marine Corps Times*, October 16, 2007.
- ²² Colonel Glenn Walters, Headquarters Marine Corps Aviation, *The Truth about the Osprey*,
<http://www.usmc.mil/marinelink/mcn2000.nsf/ac95bc775efc34c685256ab50049d458/cbc2733b633e346c85257399004a3391?OpenDocument>.
- ²³ Crouch, "The Future of Medium Lift," 75.
- ²⁴ Walters, Headquarters Marine Corps Aviation, *The Truth about the Osprey*,
- ²⁵ Crouch, "The Future of Medium Lift," 75.
- ²⁶ Ibid.
- ²⁷ Holden, MV-22 Instructor, MAWTS-1, phone conversation, December 19, 2007.
- ²⁸ U.S. Department of Defense, *DOD News Briefing with Gen Conway from the Pentagon*, April 13, 2007.
- ²⁹ Lewis, *II MEF takes a look at 2007 accomplishments*, December 12, 2007.
- ³⁰ Crouch, "The Future of Medium Lift," 75.
- ³¹ NAVAIR, V-22 Osprey Web, <http://www.navair.navy.mil/V22>.

BIBLIOGRAPHY

- 2D Marine Aircraft Wing*, "MV-22 Concept of Employment & Staff Officer Primer." Fall 2007.
- Bullard, Major John W. "MV-22 Osprey: Future Role and Impact for Medium Lift." CSC 1997.
- Commander, Naval Air Systems Command. *NATOPS Flight Manual Navy Model MV-22B Tiltrotor*. Change 58, (1 October 2006).
- Crouch, Captain Matthew R. "The Future of Medium Lift," *Marine Corps Gazette* 91, no. 11 (2007): 74-79.
- Dekraai, Captain C. E. "The Cost of a Bad Reputation: The MV-22 in Perspective." *EWS Contemporary Issue Paper*. Feb 8, 2005. <http://192168.2.226/isyquery/irl1136/12/doc>.
- Fein, Geoff. "First V-22 Squadron to Deploy to Iraq in September." *Defense Daily* 234, no. 10 (2007).
- GlobalSecurity.org. V-22 Osprey.
http://www.globalsecurity.org/military/systems/aircraft/v-22-mission_req.htm.
- GlobalSecurity.org. V-22 Osprey.
<http://www.globalsecurity.org/military/systems/aircraft/v-22-specs.htm>.
- GlobalSecurity.org. V-22 Osprey.
<http://www.globalsecurity.org/military/systems/aircraft/v-22-performance.htm>.
- GlobalSecurity.org. V-22 Osprey.
<http://www.globalsecurity.org/military/systems/aircraft/mv-22.htm>.
- Gourley, Scott R. "A global balancing act for Marine Corps aviation." Aug 17, 2005.
http://www8.janes.com/Search/printFriendlyView.do?docId=content1/janesdata/mags/jni/jni050818_1_n.shtml
- Hoellarth, John. "Leaders, experts slam Time article on Osprey." *Marine Corps Times*, October 16, 2007.

House Armed Services Committee, Tactical Air and Land Forces Subcommittee. *Statement of Mr. Thomas Laux, program executive officer for air asw, assault and special mission programs, and LtGen John castellaw, Deputy commandant for aviation, before the Tactical air and land forces subcommittee of the house armed services committee on FY 2007 Navy and Marine Corps major rotorcraft programs*, March 9, 2006.

Janay, Major Jesse A. "Taking a Hard Look at the MV-22 Osprey." *Marine Corps Gazette* 92, no. 2 (2008): 18-23.

Kovach, Major Thomas R. "Armed Escort for the Future." *CSC* 1993.

Kruzel, John J. *Osprey Aircraft to Make Combat Debut in Iraq*. April 13, 2007.
<http://www.globalsecurity.org/military/library/news/2007/04/mil-070413-afps04.htm>.

Leventhal, Rick. *Behind the Scenes: Riding in the Jump Seat of a V-22 Osprey*. December 18, 2007.
<http://www.foxnews.com/story/0,2933,316327,00.html?sPage=fn.c.foxfan/blogs>.

Lewis, Lance Corporal Brian L. *II MEF takes a look at 2007 accomplishments*. December 12, 2007.
<http://www.usmc.mil/marinelink/mcn2000.nsf/ac95bc775efc34c685256ab50049d458/d10c609e38f0d7b3852573b0004b741c?OpenDocument&Highlight=2,mef>

Lubold, Gordon. "U.S. Marines' MV-22 Osprey Test: Combat," *The Christian Science Monitor*, December 7, 2007.

Montgomery, Dave. *1st squadron of V-22s quietly deployed to Iraq*. September 19, 2007.
<http://www.navair.navy.mil/V22/index.cfm?fuseaction=news.detail&id=191>.

NAVAIR, V-22 Osprey Web.
<http://www.navair.navy.mil/V22/index.cfm?fuseaction=aircraft.main>.

NAVAIR, V-22 Osprey Web. <http://www.navair.navy.mil/V22>.

- Pawson, Captain G. J. "MV-22 and the CASEVAC Mission." *EWS Contemporary Issue Paper*. Feb 2006.
<http://192168.2.226/isyquery/irl1136/14/doc>.
- Peacock, Lindsay. "Make or break? Osprey prepares for first operational deployment." *International Defence Review*, September 01, 2007.
- Rentz, Major David S. *The Osprey and the Future of Medium Lift*. CSC 2005.
<http://192.168.2.226/isysquery/irl1136/19/doc>.
- Secretary of the Navy. *Air Naval Tactics, Techniques, and Procedures 3-22.3-MV22*. (August 2007).
- Thompson, Alison. "MV-22 Pilot Transition Plan." *Marine Corps Gazette* 90, no. 5 (2006): 24-25.
- Thompson, Estes. *Marine Corps excited about future of Osprey*. Associated Press, July 23, 2005.
<http://www.globalsecurity.org/org/news/2005/050723-osprey.htm>.
- Thompson, Mark. "The Osprey: A Flying Shame." *TIME*, October 8, 2007.
- Thompson, Mark. "Giving the Osprey More Firepower." *TIME*, October 17, 2007.
- U.S. Department of Defense, *DOD News Briefing with Gen Conway from the Pentagon*. April 13, 2007.
<http://www.defenselink.mil/Transcripts/Transcript.aspx?TranscriptID=3932>.
- U.S. Marine Corps. *Ospreys' seize MAGTF Training*. U.S. Fed News Service, including US State News. Washington, D.C. Mar 2, 2007.
<http://proquest.umi.com/pqdweb?index=0&did=1226358541&SrchMode=1&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1204288298&clientId=32176>
- Walsh, John. Kratz, Louis A. "Team Osprey Redefines Training." *Defense & AT-L* 34, no. 2 (2005): 18-21.
<http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=16269446&site=ehost-live>.

Walters, Colonel Glenn, Headquarters Marine Corps Aviation.
The Truth about the Osprey.
<http://www.usmc.mil/marinelink/mcn2000.nsf/ac95bc775efc34c685256ab50049d458/cbc2733b633e346c85257399004a3391?OpenDocument>

Whittle, Richard. "Military/Utility: Osprey Heads to Iraq."
Rotor & Wing 41, no. 10 (2007).

Zahn, Lance Corporal Christopher, 2nd Marine Division. 2nd
LAR Marines practice MV-22 Osprey casualty evacuation.
<http://www.usmc.mil/marinelink/mcn2000.nsf/ac95bc775efc34c685256ab50049d458/e7a065f5895627fc852573620069b3eb?OpenDocument>

Whittle, Richard. "Crawl, Walk, Run." *Rotor & Wing* 42, no. 2 (2008): 44-52.